

# The Spatial Linkages of Manufacturing in Montreal and its Surroundings

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## Résumé de l'article

Il est généralement admis que la force d'agglomération dans une concentration industrielle s'exprime par des liaisons fonctionnelles (transactions) entre les établissements de la région. Cet article examine quelques aspects de ce postulat. Il étudie d'abord l'interdépendance « matérielle » dans le domaine de la fabrication en vue de déterminer la force d'agglomération propre à Montréal. Les établissements sont considérés selon leur taille et leur localisation dans le complexe industriel de façon à déceler s'il existe ou non des rapports entre ces facteurs, la force de liaison et l'économie locale.

Le système des liaisons reste faible dans l'ensemble à Montréal, mais il apparaît que la force de liaison est inversement proportionnelle à la taille des établissements. On avait cru que cette force aurait diminué du centre vers la périphérie du complexe industriel. Or, ce n'est généralement pas le cas ; dans le domaine des achats, c'est même le contraire. L'auteur propose une explication, mais il faudrait plus de recherches pour mieux cerner le problème.

# THE SPATIAL LINKAGES OF MANUFACTURING IN MONTREAL AND ITS SURROUNDINGS <sup>1</sup>

*by*

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Since the publication of Weber's work (1929) on industrial location, there has been an extended theoretical discussion on external economies of scale in manufacturing industry. However, it is only in recent years that serious efforts have been made to empirically establish the existence of these postulated economies by such means as identifying the various contributory components and by measuring the strength of their agglomerative force. By definition, external economies of scale refer to economies available to firms in their transactions with other firms and organizations both inside and outside the manufacturing sector. They are believed to be most readily available in spatial concentrations (agglomerations) of firms in manufacturing and related economic activities, it being held that it is the presence of many firms in spatial proximity to one another that permits realization of large scale economies in their many transactions. For example, it is believed that it is only when there are many customers in close proximity to one another that specialist service industries can emerge to supply services at lower costs than the customer firms could provide them for themselves.

If they have real existence, external economies of scale are most likely to reside in the transactions between firms in the same agglomeration although this is not to say they need be totally confined to the same agglomeration (Britton, 1969, and Wood, 1969). Transactions are translated into tangible or non-tangible flows, consisting of the spatial transfer of information, people and material. Flows are usually described as linkages for they link firms and industries together. It is worthwhile to note Townroe's (1969) fourfold classification of them (Wood 1969, p. 34) :

- « (a) *process* : the movement of goods between different firms as stages in the manufacturing process (including subcontracting)
- (b) *service* : the supply of machinery and equipment and of ancillary parts such as tools and dies, as well as repair and maintenance requirements when supplied by separate firms.

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- (c) *marketing* : ties with other firms that aid in the selling and distribution of goods (e.g., packers, printers, wholesalers, agents and transportation concerns)
- (d) *financial and commercial* : ties with financial and advisory services such as banks, insurance companies and stockbrokers.»

Wood adds one further category observing that the above linkages require administration, thus giving rise to communication ties and further direct exchange of materials.

It is through the isolation and measurement of such linkages that researchers have attempted to ascertain the existence, effect, strength and locational significance of external economies of scale. In view of the complexity of the problem most workers in the field have singled out particular aspects of it, confining themselves to small geographical areas, one, or a few industries, or specific types of linkages. There are several examples of all these approaches. Karaska (1969), for example, researched the material linkages of manufacturing in Philadelphia, restricting himself to inter-industry connections, and working with a simple distinction between linkages confined to Philadelphia and linkages extending beyond its municipal boundaries. Bater and Walker (1971) concentrated on the service linkages of Hamilton's (Ontario) metal industries. Field and Kerr (1968) investigated the material linkages of manufacturing in general in seven urban centres in Toronto's periphery. Other approaches to the study of linkages are found in studies by Keeble (1969), Gilmour (1971), Steed (1968, 1970), Britton (1969) and Wise (1949). As a result of the efforts of these and other workers, our knowledge of linkages has increased significantly in the past few years. There are still, however, many major points to be considered before any general conclusions concerning external economies of scale may be reached.

## OBJECTIVES

This paper singles out one aspect of the broader question which hitherto has received very scant consideration. Attention is directed towards the spatial character of the material linkages of manufacturing with a view to ascertaining the extent to which they vary according to size of establishment. In making this our concern we follow the reasoning put forward by Karaska in his study in Philadelphia :

« We postulate that the agglomeration forces may in part be described by procurement actions between local manufacturing firms. The strength of the linkage with the local manufacturing system is a measure of the agglomerative force exerted by the size of the local metropolitan industrial complex. »

(Karaska, 1969, p. 354)

In this particular instance we postulate that the agglomerative force of the industrial concentration is inversely related to the size of manufacturing establishments. In other words, we anticipate that the external economies

of scale available in an agglomeration are increasingly used as the size of the establishment falls. The basis of this postulate lies in the assumption that small establishments in general cannot be as self-sufficient as large establishments, and that with increasing size, establishments are likely to « internalize » their linkages and at the same time, and as a consequence of their increasing scale of output, are likely to spatially extend their « external » linkages. Conversely reduction in the scale of the manufacturing implies a reduction in its self-sufficiency, « externalization » of linkages and an increasing reliance on other firms in the industrial complex. This general postulate is the main concern of this paper, but while subjecting it to examination, it is a simple matter to examine another related question — the effect of location of the establishment on the agglomerative force exerted by the industrial complex. We postulate that the agglomerative force as expressed through the strength of linkage with the industrial agglomeration varies according to location within the agglomeration regardless of the size of the manufacturing establishment.

The area chosen for the examination of these questions is the major industrial area of Montreal.

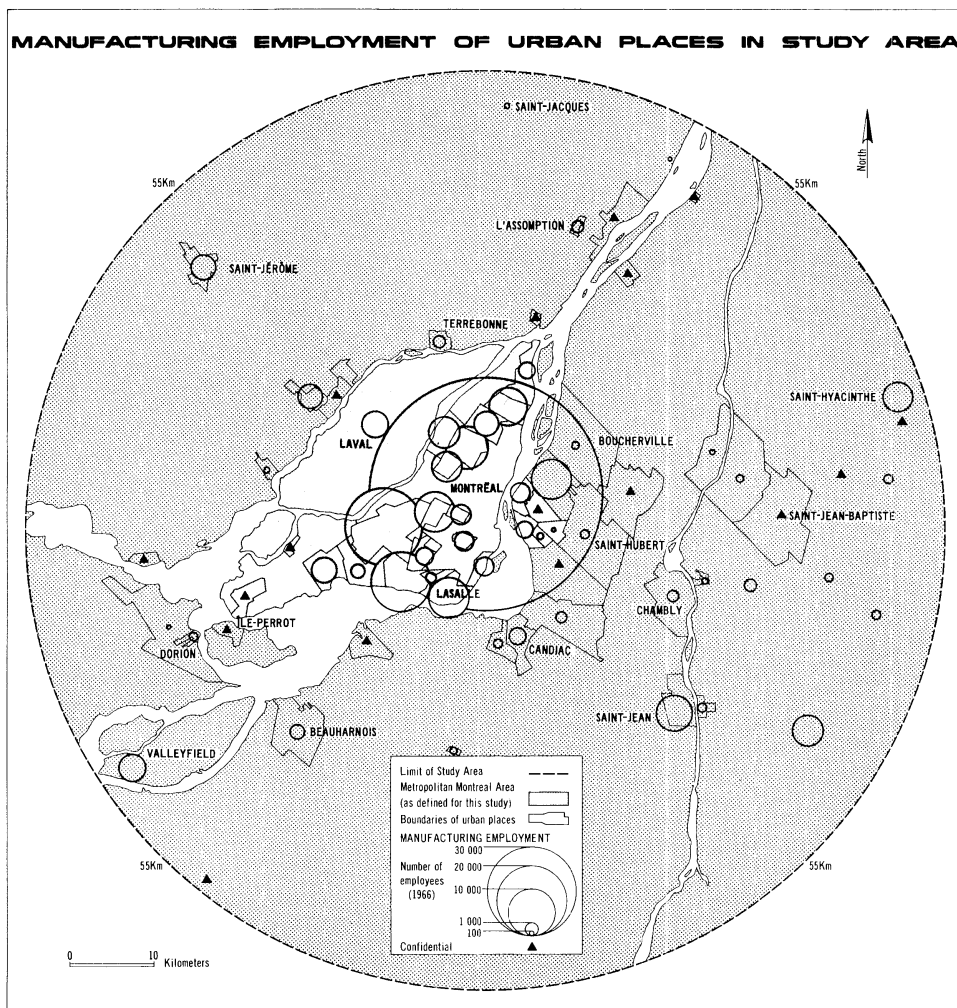
#### STUDY AREA AND SAMPLE DESIGN

Metropolitan Montreal and its surrounding region is an ideal study area to pursue the objectives stated above. With over five thousand establishments in Metropolitan Montreal in 1967 and approximately nine thousand establishments within a radius of 257 kilometers of downtown Montreal, there is every reason to anticipate that manufacturing enjoys external economies of scale. One particularly attractive feature of Montreal from the viewpoint of this study is its relative isolation from other major industrial centres. Ottawa, Kingston, Sherbrooke and Quebec City, the closest manufacturing centres of any note, are all at least 125 kilometers from the centre of Montreal, and in any case, are of comparatively small importance. There is no danger that short inter-metropolitan linkages will obscure the agglomerative force of the Montreal economy.

This paper deals with the linkages of manufacturing located within 55 kilometers of downtown Montreal (figure 1 shows the distribution of employment by municipalities in the area). The linkage data employed are part of a larger set of data that describe the linkages of manufacturing in all of southern Quebec in 1971. The data used in this paper, and the larger body of data of which they are a sub-set, were provided by manufacturing establishments selected on the basis of a stratified random sample of all establishments within 257 kilometers of downtown Montreal. Three strata were employed :

- (1) distance of establishment from downtown Montreal,
- (2) size of establishment — by employment, and
- (3) the type of manufacturing in which the establishment is engaged.

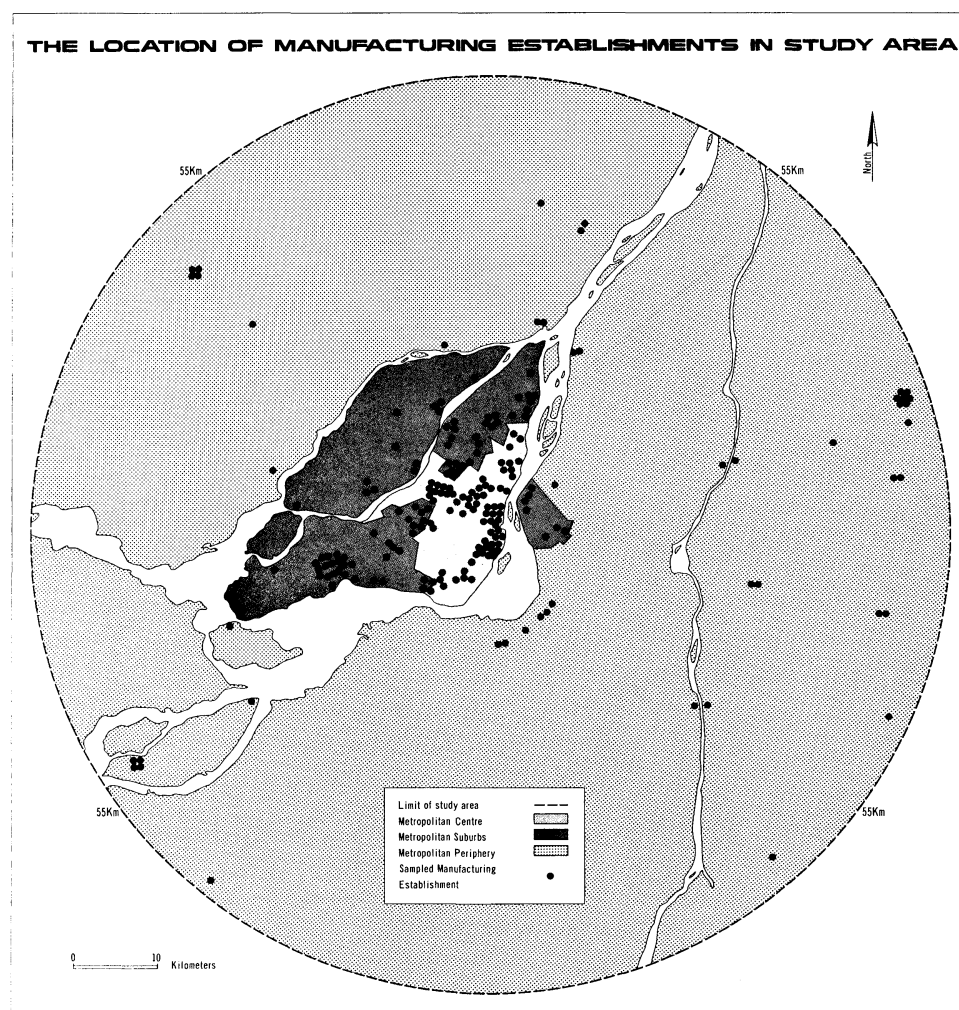
Figure 1



Each of these was divided into several sub-strata. Establishments were classified according to their distance from downtown Montreal and allocated to distance bands of 32 kilometers in width. Second, three size classes based on employment were used. These were 1-25, 26-100 and 101 employees and more. Last, all establishments were classified according to the twenty major manufacturing groups of the Standard Industrial Classification, i.e., the food and beverage industries, tobacco products industries, rubber industries and so on. On the basis of these criteria a highly representative sample of manufacturing in southern Quebec was obtained. Each sampled establishment which responded to a questionnaire supplied a wealth of data on market areas, sources of materials, strength of linkage with manufacturing and other economic activities, and several other kinds of information.

Within 55 kilometers of downtown Montreal, the area to which this paper confines itself, the total number of responding establishments was 198 – approximately three per cent of all establishments in the area. Two criteria used in deriving the sample were discarded in view of their lack of appropriateness to the major objectives of this paper. First, although the sample was partially derived by selection between different types of manufacturing, this study deals only with manufacturing as a whole and no attempt is made to compare the linkage patterns of different types of manufacturing. Second, while the establishments were selected according to their locations within distance bands, it seemed preferable to use a less rigorously defined classification of location : one which pays greater attention to the morphology of Montreal and its spatial-economic structure. Accordingly, the study

Figure 2



area is sub-divided into three zones : the metropolitan centre, the metropolitan suburbs and the metropolitan periphery (figure 2). Although a certain arbitrariness attaches to the boundaries of these areas, they approximately distinguish between the older manufacturing districts of the strongly urbanized central city, the newer industrial areas of the suburbs, and last, the old and new manufacturing in the many small and medium-sized communities in Montreal's immediate hinterland. This crude classification of locations is more suited to the unique spatial configuration of Montreal than a more accurate classification based on distance measures.

### SPATIAL PATTERNS OF LINKAGES

It is useful to begin by examining some aspects of the spatial patterns of the material linkages of manufacturing in the study area without consideration of the size of establishment. This gives a crude idea of the agglomerative force of the Montreal economy and permits some very limited comparisons with other areas for which linkage studies have been undertaken.

**Table 1**

***Total Spatial Linkage with Metropolitan Montreal***

<i>Location</i>	<i>No. of estab.</i>	<i>% of sales to metro</i>		<i>% of purchases from metro</i>		<i>Total linkage</i>	
		<i>unweighted</i>	<i>weighted</i>	<i>unweighted</i>	<i>weighted</i>	<i>unweighted</i>	<i>weighted</i>
Centre	80	39.5	29.8	35.7	31.9	37.6	30.8
Suburbs	74	32.5	30.3	35.6	30.4	34.0	30.4
Periphery	44	31.2	24.9	46.6	35.5	38.9	30.2
Entire area	198	34.4	27.3	39.3	31.6	36.8	29.5

Source : In this table, as in all subsequent tables, the data were collected and processed by the writers. The data refer to the year 1971.

A basic picture of the strength of connection with Montreal is provided by Table 1 which shows output linkages (sales), input linkages (purchases) and total linkages (derived by averaging the percentages for the other two linkages). The unweighted figures were derived by taking averages with each establishment weighted equally, while the weighted figures were derived by taking account of the size of establishments (by employment) in calculating the averages. The Table shows that manufacturing within 55 kilometers of downtown Montreal is more dependent upon Metropolitan Montreal for purchases of materials than for sales. However, the difference is slight and is not considered to be of any significance. Much more important is the fact that more than two thirds of all purchases and sales (when establishments are weighted by size) are made outside Metropolitan Montreal. This suggests

that as far as material linkages are concerned the agglomerative force of the Montreal economy is rather weak. However, limited findings from other cities lead us to believe that Montreal is not unusual in this regard. It was found by Field and Kerr that firms in Toronto's periphery made only 26% (weighted) of their sales in Metropolitan Toronto. Their estimate of suburban sales (weighted) to Toronto was 35% (1968, p. 50). For Philadelphia firms, Karaska's estimate of local purchases was 37% (1969, p. 359). The situation in Montreal, therefore, may be a rather typical one, although studies of many other cities are needed to establish that point beyond any doubt.

**Table 2*****Sales Areas (by Size of Establishment)***

<i>Size of establishments (employees)</i>	<i>Number of establishments</i>	<i>Metro Montreal</i>	<i>% of sales made to Quebec (incl. Montreal)</i>	<i>Elsewhere</i>
1 — 25	53	41.4	70.0	30.0
26 — 100	71	35.1	55.9	44.1
101 +	74	26.6	45.8	54.2

When establishments are separated according to size, as in Tables 2, 3 and 4, it is evident that industrial linkage with Metropolitan Montreal, and other areas, varies considerably. In examining these Tables it should be borne in mind that distance from the centre of Montreal is not considered. Each size category is composed of plants from all parts of the study area.

**Table 3*****Source Areas of Materials (by Size of Establishment)***

<i>Size of establishments (employees)</i>	<i>Number of establishments</i>	<i>Metro Montreal</i>	<i>% of Purchases from Quebec (incl. Montreal)</i>	<i>Elsewhere</i>
1 — 25	53	46.7	67.6	32.4
26 — 100	71	41.2	54.7	45.3
101 +	74	30.0	47.8	52.2

The figures largely speak for themselves. The smallest establishments have the strongest connections with Montreal, and with the Province of Quebec as a whole, in sales and purchases, and therefore in total linkage. Almost 70% of their total linkage is with the Quebec economy, and less



**Table 4**  
***Total Linkage (by Size of Establishment)***

<i>Size of establishments (employees)</i>	<i>Number of establishments</i>	<i>Metro Montreal</i>	<i>% of total linkage with Quebec (incl. Montreal)</i>	<i>Elsewhere</i>
1 — 25	53	44.1	68.8	31.2
26 — 100	71	38.1	55.3	44.7
101 +	74	28.3	46.8	53.2

than a third with the rest of Canada and other parts of the world. Their input linkages with Metropolitan Montreal are particularly strong, constituting nearly 50% of purchases by value. As size of establishment increases, the strength of linkage with the Montreal economy and with the entire Province of Quebec becomes weaker. The largest establishments, those with over 100 employees, have the weakest linkages with the region in which they are located. Less than a third of their sales and purchases are made in Metropolitan Montreal, and over half of all their connections are made outside the Province. It should be noted that in all size groups the strength of linkage with Metropolitan Montreal is stronger in purchases than in sales.

**Table 5**  
***Total Linkage to Metropolitan Montreal (by Size of Establishment and Location)***

<i>Size of establishments (employees)</i>	<i>Location of establishments</i>	<i>Number of establishments</i>	<i>Sales %</i>	<i>Purchases %</i>	<i>Total Linkage %</i>
1 — 25	centre	20	54.1	45.2	49.6
1 — 25	suburbs	17	38.3	40.5	39.4
1 — 25	periphery	16	31.9	54.3	43.1
26 — 100	centre	31	37.3	34.5	35.9
26 — 100	suburbs	25	32.1	36.1	34.1
26 — 100	periphery	15	35.8	52.8	44.3
101 +	centre	29	27.1	27.4	27.2
101 +	suburbs	32	27.1	30.1	28.6
101 +	periphery	13	25.8	32.6	29.2

The situation assumes a somewhat more complex character when linkage is considered in relation to size and location of establishments (Tables 5 and 6). The strength of linkage with Metropolitan Montreal varies not only by size of establishment but also by location of establishment. The most significant points emerging from these Tables are as follows.

First, the smallest establishments do not have the strongest linkage with Montreal in every case. In the periphery, medium-sized establishments have a slightly greater linkage with Montreal than small plants, although in the other two locations small plants have a considerably greater linkage with Montreal than medium-sized or large establishments. Second, the medium-sized and large establishments exhibit a spatial pattern in their linkages that is quite surprising. The establishments in the periphery have a stronger con-

Table 6

*Total Linkage to Areas other than Quebec (by Size of Establishment and Location)*

<i>Size of establishments (employees)</i>	<i>Location of establishments</i>	<i>Number of establishments</i>	<i>Sales %</i>	<i>Purchases %</i>	<i>Total Linkage %</i>
1 — 25	centre	20	25.8	37.6	31.7
1 — 25	suburbs	17	32.6	42.6	37.6
1 — 25	periphery	16	31.5	16.4	24.0
26 — 100	centre	31	45.6	51.5	48.6
26 — 100	suburbs	25	51.7	54.2	52.9
26 — 100	periphery	15	34.9	30.4	32.7
101 +	centre	29	45.8	52.2	49.0
101 +	suburbs	32	62.9	51.0	56.9
101 +	periphery	13	44.4	53.4	48.9

nection with Montreal than either those in the suburbs or the centre. It is only in the case of small establishments that the periphery has a weaker connection than the centre with Montreal. Third, in no size class is there a constant diminution in the strength of total linkage with the metropolitan economy from the inner zone to the outer zone. Indeed, amongst the establishments with 101 employees and more, the reverse situation occurs. There is a slight increase in the strength of linkage with Metropolitan Montreal from the centre of the agglomeration outwards to its periphery. But the differences are not great, and clearly, the largest establishments (as shown in preceding tables) have the weakest linkage with Montreal and the strongest linkage with markets and material sources beyond Quebec's borders.

This is especially noticeable amongst large establishments in the suburbs. Almost 63% of their sales are made outside Quebec, and their total linkage outside the province is greater than their linkage within. Although the same traits are not quite so marked amongst the small and medium-sized establishments (particularly the former), it is nevertheless true that it is the suburban establishments which have the weakest linkages with the local economy. It appears as if suburban establishments of all size groups are disturbing the overall pattern of spatial linkages. Their spatial interconnections are quite distinctive, and are oriented in such a way as to create a zone of weak linkage between the metropolitan area and its hinterland. Establishments in the centre and the periphery have their strongest ties with the local and regional economy, while suburban establishments are more strongly interconnected with the national economy.

#### TYPE OF LINKAGES AND SIZE OF ESTABLISHMENTS

It is clear that the spatial characteristics of material linkage are somehow related to the size of establishments. However, in reaching that conclusion no attention has been paid to the different types of material linkages which exist.

**Table 7**  
*Type of Market Served (by Size of Establishment)*

Size of establishments (employees)	Number of establishments	% Distribution of Sales			Other
		Manufacturing	Wholesale	Retail	
1 - 25	53	35.6	28.0	19.2	17.2
26 - 100	71	39.1	27.9	19.2	11.8
101 +	74	42.4	20.3	22.8	14.5

Establishments have linkages with other manufacturing establishments, with wholesalers, retailers and other economic activities such as the primary extractive industries and a variety of private and public activities. This brief

**Table 8**  
*Type of Material Sources (by Size of Establishment)*

Size of establishments (employees)	Number of establishments	% Distribution of Purchases		
		Manufacturing	Wholesale/retail	Other
1 - 25	53	62.6	30.5	6.8
26 - 100	71	72.1	23.3	4.6
101 +	74	70.3	25.1	4.6

section is concerned to ascertain whether or not the strength of linkage with various activities varies according to size of plant. In this case the examination is not guided by postulates. Insufficient is known about this aspect of inter-industrial linkages to permit any approach other than a purely exploratory one.

From Tables 7, 8 and 9 it can be seen that there are certain characteristics of the linkages of Montreal's manufacturing which are common to establishments of all sizes. Perhaps the most significant characteristic is the much greater linkage with manufacturing on the input side than on the output side. For example, establishments with 101 employees and more, buy 70.3% of their materials from manufacturing, but sell only 42.4% of their output to that sector. The second common characteristic is that linkage with manufacturing is the greatest single linkage both in sales and purchases. It is also therefore the greatest single total linkage of manufacturing in Montreal and its region.

Table 9

*Total Linkage to Economic Sectors (by Size of Establishment)*

<i>Size of establishments (employees)</i>	<i>Number of establishments</i>	<i>Manufacturing</i>	<i>% of Total Linkage Wholesale/retail</i>	<i>Other</i>
1 — 25	53	49.6	38.8	12.0
26 — 100	71	55.6	35.2	8.2
101 +	74	56.3	34.1	9.6

When establishments are considered in terms of size there is evidence of some differentiation in their types of linkages, but this is much more blurred than the differences that were observed in sales areas and source areas of materials. In the case of sales linkages to the manufacturing and other economic sectors, the evidence suggests that there is a relationship between the size of establishments and the relative importance of sales to manufacturing. The strength of linkage with manufacturing increases in a quite definite manner from the smallest to the largest establishments. A reverse trend occurs in the sales to the wholesaling and retailing sectors, but as the small and medium-sized establishments have approximately the same reliance on these sectors, it cannot be claimed that the trend is a particularly distinct one. Further data and analysis are clearly required to establish the nature of the relationship between size of firm and the relative importance of different types of sales linkages. Nevertheless, there is an indication that certain definite relationships may exist. In view of the data contained in Table 8, there is no evidence of a relationship between size of firm and the relative importance of the various types of linkages on the input side (purchases). Once again, however, this merits further examination, because there is suggestion that the smallest plants have a different set of

Table 10

*Percentage Distribution of Linkages (by Area and by Size of Establishment)*

Size of establishments	Location of establishments	Manufacturing			Wholesaling/ Retailing			Other		
		SL <sup>1</sup>	PL <sup>2</sup>	TL <sup>3</sup>	SL	PL	TL	SL	PL	TL
1 - 25	centre	25.7	65.5	45.6	67.9	33.0	50.4	6.4	1.5	4.0
1 - 25	suburbs	44.1	68.9	56.5	36.2	25.2	30.7	19.7	5.9	12.8
1 - 25	periphery	38.8	52.4	45.6	33.1	33.2	33.1	28.1	14.4	21.3
26 - 100	centre	39.5	71.6	55.5	43.8	21.9	32.8	16.7	6.5	11.7
26 - 100	suburbs	40.4	70.5	55.4	53.6	28.9	41.2	6.0	0.6	3.4
26 - 100	periphery	36.0	75.6	55.8	43.4	16.6	30.8	20.6	7.8	14.2
101 +	centre	45.6	68.2	56.9	48.5	22.8	35.6	5.9	9.0	7.5
101 +	suburbs	39.1	71.0	55.0	35.7	27.9	31.8	25.2	1.9	13.2
101 +	periphery	39.2	73.1	56.1	48.5	23.1	35.8	12.3	3.8	8.1

Notes: 1. SL = Sales linkage

2. PL = Purchase linkage

3. TL = Total linkage

linkages from other establishments. They appear to be less reliant on manufacturing and more dependent upon wholesaling, retailing and other activities for their material inputs than larger sized establishments. It is possible that a finer classification of firms by size would be more revealing of any possible relationships.

When location is considered in addition to size of establishment (Table 10) no indications of possible relationships between location, size and relative strength of the different types of linkages are apparent. In almost all size classes there is no discernible pattern in the relative strength of linkages as location changes. Likewise, within the locational groups, the relative strength of linkage with different sectors appears to vary quite randomly. All things considered there is little evidence to suggest that as a general rule location has much bearing on the relative strength of manufacturing's linkages with various economic activities, including itself.

Although Table 10 fails to reveal any immediately apparent relationships, it does show some interesting features of linkages which probably deserve further examination. The first point is that the smallest establishments, those with 1 to 25 employees, appear to be in a class of their own. Medium-sized and large establishments certainly differ in a number of respects, but they have more features in common than they have with establishments in the smallest size category. A striking example of their similarity is provided by their almost uniform total linkage with manufacturing (Table 10, column 3). The second point is that the distinctiveness of small establishments is most highly developed amongst those located in the very centre of the industrial agglomeration. In particular, small establishments in the centre sell an exceptionally small proportion of their output to manufacturing and a particularly high proportion to the wholesaling and retailing sectors. In addition, small plants in general also have a distinctiveness in their purchasing patterns. They buy a lower than average proportion of their

inputs from manufacturing and an above average proportion from wholesalers and retailers.

## CONCLUSIONS

If the agglomerative force of an industrial complex is partly described by the procurement actions between local firms, it may be concluded that the agglomerative force of Montreal as it relates to the interchange of materials between firms is rather weak. The strength of the linkage with Montreal as expressed by material flows within the local manufacturing system is considerably weaker than the strength of the linkage with firms outside Montreal. This suggests that external economies of scale in the procurement of inputs and the distribution of outputs to other firms in the same industrial complex do not play a prominent role in explaining the high locational preference of firms for the Montreal area. Of course, this conclusion leads one to anticipate that if external economies of scale are available to manufacturing firms in Montreal, and for that matter, in all industrial complexes, they reside in the transactions related to non-material connections to a greater extent than in the transactions related to material connections. That is, the agglomerative force of the complex may be more strongly expressed in the strength of linkage with firms which are involved in service, financial and commercial transactions (as defined in Townroe's classification presented at the beginning of the paper) than with firms which are directly involved in the interchange of material inputs and outputs. So far, very little work has been done on non-material linkages. However, Bater and Walker found that the Hamilton metal industries had 81% of their service linkages (with services defined in the widest sense) with the Hamilton area (1971, p. 35). This is strong evidence, but until a greater range of manufacturing in a greater number of complexes is examined, it would be hasty to conclude that the external economies of scale largely reside in service connections rather than in those connections which are part of the manufacturing process.

The above finding relates to manufacturing industry considered as an entity and does not impinge on the first and main postulate of this paper. When firms are considered in terms of their size it appears that the agglomerative force of Montreal in regard to the interchange of materials between firms increases as firms become smaller. Small firms have stronger connections with the local industrial economy. This suggests that external economies of scale exert a weakening locational pull as the size of establishments increases.

The second postulate was that the agglomerative force of the metropolitan industrial complex varies according to the location of establishments in and around the complex. Underlying this postulate was the notion that the strength of linkage with the industrial complex is related to the distance of establishments from its centre. Examination of this idea produced surprising results, particularly in the purchase linkages. First, in all size

classes the strongest input linkage with Metropolitan Montreal is that of the establishments in the periphery. Second, in the case of the medium-sized and large establishments, it is those in the centre which have the weakest linkage with Montreal. This represents an almost complete reversal of what was anticipated. There is no obvious explanation for it, but we can offer some tentative ideas which could be subjected to investigation.

Establishments in the small communities of the periphery can acquire practically none of their inputs from other establishments in their respective communities, whereas establishments in the industrial complex, can, if they so wish, procure a large proportion of their inputs from firms in that complex. For the peripheral establishments, Montreal is the closest large industrial centre from which many of their inputs may be obtained. For the establishments in Montreal, alternative sources for inputs are found in other large industrial complexes that are comparable to Montreal. Such complexes also represent alternatives to Montreal for the peripheral establishments, but we would suggest that peripheral establishments are less likely to go beyond Montreal for the procurement of materials than the establishments located in Montreal. This should be qualified, however, to take account of the size of establishments. As establishment size increase the dependance upon Montreal for inputs diminishes, so that it is the small and medium-sized peripheral establishments which have a particularly high dependence upon Montreal for their inputs.

There are probably several reasons why the smaller establishments rely heavily on Montreal and thus have a higher dependence upon it than firms actually located there. First, there may be a time and distance factor in the transportation of inputs to the periphery from industrial centres other than Montreal ; a factor which would unnecessarily add to the costs of peripheral firms. There is, for example, a likelihood that shipments would be routed through Montreal, and then channelled to the peripheral towns, thus causing transshipment costs not experienced by firms within the complex itself, and increasing the length of time required for completion of deliveries. Another factor to be considered is the possibility that manufacturing in the periphery tends to be of such a nature that it can more easily procure its inputs within the regional economy than can manufacturing in Montreal. This factor, or consideration of it, may have guided the locational choice between the city and the periphery in the first place. One suspects that firms which have need of interregional linkages are more likely to locate within an industrial complex than firms which can procure most of their inputs within the local region. If this point could be verified by means of empirical investigation it would be of considerable significance, because it conflicts with some of our long held ideas about external economies of scale, and agrees with others. For example, it is generally believed that an important locational attraction of spatial concentrations of manufacturing is the existence of economies in the inter-change of materials between firms in the same concentration. The evidence of this paper casts some dubiety on that notion. On the other hand,

industrial complexes are generally cited as offering external economies of scale in transportation and communications. Since the establishments in the Metropolitan area have weaker linkage with the Metropolitan area than firms located in the periphery, it seems reasonable to assume that the metropolitan establishments are partly drawn to the complex because of the economies it offers in inter-metropolitan transportation and communications. There is one final speculation we offer with respect to purchase linkages. It is possible that their spatial pattern is related to the knowledge about potential input suppliers possessed by establishments. We may speculate that smaller establishments in the periphery have less information on suppliers than smaller establishments within the industrial complex and larger establishments both within the complex and in the periphery. Their knowledge may be largely confined to Montreal suppliers. This is a very conjectural point but it could conceivably play a role in affecting the spatial pattern of purchase linkages.

The sales linkages more closely approximated our anticipations, even though it was only the small establishments which exhibited an unequivocal diminution in the strength of linkage with Montreal from the centre to the periphery. There is a hint of such a diminution amongst the medium-sized and large establishment. The evidence, however, is not conclusive. The outstanding feature of sales linkages, and one deserving of investigation, is the exceptionally strong linkage of medium-sized and large establishments with distant areas. This is also true of their purchase linkages and total linkages, although not quite so marked.

Finally, the size and location of establishments do not appear to be related to the relative strength of linkage with different economic sectors. However, there does appear to be a distinctiveness in the purchasing and sales linkages of small establishments, particularly those in the centre of the industrial complex. As with many of the other findings of this paper there is need here for further investigation.

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#### ABSTRACT

**BROOKS, Stanley, GILMOUR, James M., MURRICANE, Kenneth : The Spatial Linkages of Manufacturing in Montreal and its Surroundings.**

It has generally been believed that the postulated agglomerative force of industrial concentrations expresses itself in economies in the transactions (linkages) between firms in the same concentration. This paper examines aspects of this long-held idea by considering material linkages of manufacturing in Montreal with a view to ascertaining the agglomerative strength of Montreal in regard to these linkages. More importantly, establishments are considered according to size and to location within the industrial complex in order to establish whether or not there is a relationship between these factors and the strength of linkage with the local economy.

The overall linkage with Montreal is weak, but there is no doubt that the strength of linkage with Montreal varies inversely with the size of establishments. It was anticipated that the strength of linkage with Montreal would diminish from the centre to the edge of the industrial complex. In general, this does not prove to be true. In the case of purchase linkages the opposite occurs. Tentative explanation is given but further investigation is needed.

**KEY WORDS : Manufacturing, Spatial linkages, Region of Montreal, Quebec, Canada**

#### RÉSUMÉ

**BROOKS, Stanley, GILMOUR, James M., MURRICANE, Kenneth : les liaisons spatiales dans l'industrie manufacturière à Montréal et ses environs.**

Il est généralement admis que la force d'agglomération dans une concentration industrielle s'exprime par des liaisons fonctionnelles (transactions) entre les établissements de la région. Cet article examine quelques aspects de ce postulat. Il étudie d'abord l'interdépendance « matérielle » dans le domaine de la fabrication en vue de déterminer la force d'agglomération propre à Montréal. Les établissements sont considérés selon leur taille et leur localisation dans le complexe industriel de façon à déceler s'il existe ou non des rapports entre ces facteurs, la force de liaison et l'économie locale.

Le système des liaisons reste faible dans l'ensemble à Montréal, mais il appert que la force de liaison est inversement proportionnelle à la taille des établissements. On avait cru que cette force aurait diminué du centre vers la périphérie du complexe industriel. Or, ce n'est généralement pas le cas ; dans le domaine des achats, c'est même le contraire. L'auteur propose une explication, mais il faudrait plus de recherches pour mieux cerner le problème.

**MOTS-CLÉS : Industries, Liaisons spatiales, Région de Montréal, Québec, Canada.**